Revegetation
Supplement 2.11

Historical Research

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The first European beef animals to enter the New World were introduced by ship and unloaded in southern Mexico during 1521 (Wagoner 1952). Cattle and sheep were introduced into the semi-desert grasslands in the Chihuahuan and Sonoran Deserts as the Spanish began exploring the northern frontier. Livestock distribution continued to expand as Father Kino and Spanish explorers established missions and trading posts in Arizona and New Mexico. Between 1770 and 1827, Spanish cattlemen were frequently forced from the frontier by Indians, malaria and drought (Bahre 1977). Well over 500,000 cattle freely roamed the frontier, and many were killed for food and hides between 1830 and 1840 (Humphrey 1958).

American botanists and military personnel (Bartlett 1854, Hinton 1890, Barnes 1936) traveling in the valley bottoms of the semi-desert grasslands noted lush sacaton *(Sporobolus airoides* and *Sporobolus wrightii)* and gramagrasses (*Bouteloua spp.*). Upland mesas and canyons were relatively brush-free and dominated by gramagrasses and bluestems (*Andropogon spp.).* Brushy species such as mesquite *(Prosopis spp.)*, catclaw and whitethorn *(Acacia spp.)*, creosotebush *(Larrea tridentata)* and tarbush *(Flourensia cernua)* were present but limited in numbers. Early explorers consistently write about: (1) their inability to find firewood between Midland TX and Wilcox AZ, and (2) the constant burning of grasslands by Indians in southwest TX, southern NM and southeastern AZ (Humphrey 1958).

After the American exploration and the control of most Indian tribes, American and Mexican cattlemen freely grazed the semi-desert grasslands (Wagoner 1952). Railroad expansion, following the American Civil War and the revolutions in Mexico, provided rapid transportation and movement of agricultural and mining products (Hastings and Turner 1965). As human population increased so did the demand for meat, vegetables and fiber. Cattle, sheep, goats and pigs were driven or shipped from eastern Texas and northeastern Mexico into southern New Mexico to graze the mesas and canyons; while fertile lowlands were plowed and rivers re-channeled to provide irrigation for crops. Most water sources dried up in 1893, resulting in the death of 50 to 75 percent of the livestock population. The drought was over by 1895, but the combined effects of overgrazing the uplands, drought and flooding had resulted in accelerated sheet and gully erosion and the loss of shallow water tables in valley bottoms (Bryan 1925).

Griffith (1901) reviewed the deterioration of southwestern rangelands in 1899 and published statements of area ranchers. H. C. Hooker, owner of the Sierra Bonita Ranch in southeastern Arizona, described the destructive events: *"In 1870 there were large beds of sacaton and grama grasses and the river ran shallow with banks covered with grass, shrubs and cottonwood trees. In 1900 the river bed had dropped 20 feet and the vegetation had been removed by grazing, farming and flooding."* Commenting on livestock numbers, Hooker stated: *"There were fully 50,000 head of cattle at the upper* *end of the valley in 1890. In 1900 there were not more than one-half that number, and they are doing poorly."* C. J. Bayless, another Arizona-New Mexico rancher, stated: *"Beaver dams checked water flow in 1885, but the trappers exterminated the population, and within 5 years the channel was from 3 to 20 feet deep."* Bayless grazed 40,000 cattle in 1888, but in 1901 there was insufficient forage for 3,000. Other observations (Bartlett 1854, Hinton 1890, Barnes 1925, Bryan 1925) indicate similar vegetation changes throughout the Chihuahuan and Sonoran Deserts.

Historical records clearly illustrate that southern New Mexico and southeastern Arizona desert grasslands were overgrazed and deteriorated rapidly between 1880 and 1930 (Bahre 1977, Bartlett 1854, Cooke and Reeves 1976, Humphrey 1958, York and Dick-Peddie 1969, Herbel *et al*. 1973, Hastings and Turner 1965). Griffith (1901) and *Cox et al.* (1983) documented changes in vegetation, corresponding livestock losses, and reductions in livestock populations.

Cooperative studies to restore desert grassland ecosystems were initiated in the early 1900s by the Division of Agrostology (USDA) and the State Experimentation Stations at Las Cruces, NM and Tucson, AZ. Between 1890 and 1980, the seed of more than 300 forb, grass, shrub and tree species were sown at 400 planting sites within the Chihuahuan and Sonoran Deserts (Cox *et al.* 1982). Fourteen of the species were widely adapted in both deserts. Eleven of the adapted species were introduced perennial grasses, two were native perennial grasses, and one was a native perennial shrub.

Because native plants were more difficult to establish from seed, state and Federal scientists, and land managers usually seeded introduced plants. This trend began to change in the 1970s, when it was recognized that introduced plants often replaced native plant populations. Between 1970 and 1995, a series of scientific investigations were initiated to compare establishment characteristics of both native and introduced plants, and to develop revegetation techniques to aid in the establishment of native plants (Cox *et al*. 1982, Friseur *et al.* 1985, Cox *et al.* 1987).

Plant establishment from seed requires a viable seed and a favorable environment for seedling development. Seed often germinate, but seedlings fail to survive because inadequate soil moisture has limited the development of a root system capable of supporting the plant through later periods of less favorable soil moisture conditions. Available soil moisture was a factor in the establishment of blue grama (*Bouteloua gracilis*), crested wheatgrass (*Agropyron desertorum*) and Russian wildrye (*Elymus junceus*) in cold deserts (Briske and Wilson 1977, 1978, 1980, Wilson and Briske 1979; Hassanyar and Wilson 1978), and sideoats grama (*Bouteloua curtipendula*), Lehmann lovegrass (*Eragrostis lehmanniana*), Boer lovegrass (*Eragrostis curvula*) and blue panicgrass (*Panicum antidotale*) in hot deserts (Frasier *et al.* 1984, 1985). Water stress during germination and seedling development was detrimental to the survival of cool- and warm-season grasses, shrubs and trees from Arizona to Texas (Knipe 1968, 1973; Piatt 1976; Kruse 1970; Scifres and Brock 1969).

Wilson and Briske (1979b), Frasier *et al.* (1984) and Cox *et al.* (1993) found that grasses, shrubs and trees required four to six days of moist soil conditions and soil temperatures between 15 and 35^{o}C to germinate and initiate seminal root growth. To insure adventitious root growth and plant establishment, the first wet period must be followed by a second wet period after two to eight weeks.

In southeastern New Mexico and north central Mexico (the Chihuahuan Desert), the amount and distribution of late summer, and fall-winter precipitation needed to insure native seed germination and seedling establishment can be expected in one of ten years (Herbel *et al.* 1973, Mexico Climatic Reporting Stations 1992, FAO-UNESCO 1975). Because precipitation probabilities are low Cox *et al*. (1989) and Houser (1983) suggested transplanting techniques to establish native perennial plants.

To increase the success of plant establishment, foresters (Tinus 1978), landscape architects (Aratani 1976), mine reclamationists (Howard *et al.* 1978) and wildlife biologists (Springfield 1972, Ferguson *et al.* 1975) have transplanted containerized greenhouse grown seedlings and provided supplemental irrigation during establishment.

Transplant survival was dependent upon a continuous supply of soil moisture for approximately 30 days (Cox *et al.* 1989). Therefore, transplanting dates should follow the expected initiation of the summer rainy season when plants would have the greatest likelihood of success.

Cox and Madrigal (1988) transplanted, and Thacker and Cox (1992) seeded perennial native forage plants on rangelands and abandoned farmland in the Chihuahuan and Sonoran Deserts in North America. The establishment potential on both land types was similar, but the costs associated with clearing rangeland was 10 to 15 times greater than planting and irrigating at abandoned farmland sites, and the survival of transplants was 250 times greater than for seeded plants.

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